US House of Representatives
Committee on Science
Subcommittee on Energy
- DRAFT -

Testimony
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2318 Rayburn House Office Building
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Speaker:
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Opening
Thank you Chairman Biggert and Ranking Member Honda. It is a great honor to present the New York Institute of Technology's (NYIT) and the US Merchant Marine Academy's (USMMA) Solar-Hydrogen Home, our 2005 Solar Decathlon Entry, to the Subcommittee on Energy.

My name is David Schieren and I am a graduate Energy Management Student from NYIT. With me today is Heather Korb, Lead Architect from NYIT and Greg Sachs, Lead Engineer from the USMMA.

For the past 2 years NYIT and the USMMA have been working on an extraordinary project – an advanced Solar Hydrogen home. We strongly believe that solar energy, renewable hydrogen and sustainable design offer a future of true energy independence, a clean environment, and a greatly enhanced civilization.

Our progress has been realized through extensive interdisciplinary team efforts. Key students, faculty, and staff worked tirelessly, often without remuneration, to pursue this vision of a better world.

Project Overview
First a vision, a philosophy of sustainability, then a design competition, and the project blossomed.

NYIT's Solar Home is called Green Machine/Blue Space (Rendering). Green Machine, the life support of the house and Blue Space, the dwelling place, are two parts working together as one self-sustaining unit. (Pictures)

Green Machine (Pictures)

- GM is a modified shipping container that houses the mechanics of life including a kitchen, a bathroom, roof garden for food production, solar water heating, and hydrogen production and storage.
- Containers are ubiquitous, and we consider them a pre-made space- structurally sound and easily transported by rail, air and sea. This system is ideal for numerous applications, including disaster relief, and military uses.

Blue Space (Pictures)

- Blue Space is a site-specific design that emphasizes dwelling quality and sustainability through materials selection, efficiency, passive solar strategies and natural ventilation.
- Through design, the energy load was minimized, reducing the on-site power requirements.

Power Systems: Solar-Hydrogen

Solar panels are the primary source of energy, and a hydrogen fuel cell is used for nighttime energy requirements. (Pictures, Systems diagram)

- Solar panels convert sunlight into electricity and send it to the house loads.
- Surplus solar energy is sent to a hydrogen generator that produces hydrogen gas from water
- When there is no sunlight, the fuel cell converts the hydrogen gas back into electricity to power the house
- This is a quiet and clean process: The fuel-cell byproducts are water and heat, and the water is used again and converted back into hydrogen, creating a regenerative cycle.

Benefits

- This is a vital demonstration project: Applying these technologies will help determine how to improve it.
- Hydrogen produced in this way can replace fossil fuels and end dependency on foreign nations for our energy supplies.
- Hydrogen gas is superior to and more versatile than other energy storage technologies, such as batteries.
- This is the model of a new energy paradigm, a *distributed generation energy system* – inherently stronger than the centralized and interdependent system of today.

My testimony today will specifically address the subcommittee's questions:

1.

Q: Given your experience, what do you think are the main technical and other barriers to greater use of solar energy?

A: In general, the solar energy equipment and infrastructure available today is high quality and it does an excellent job of powering a home, as demonstrated with the Solar Decathlon entries and thousands of homes across the country. However, there are barriers to overcome before mass adoption, including:

- Lack of education and public awareness about the benefits of solar energy and the true costs of the current fossil fuel based system to the environment and national security.
- The high cost and short supply of solar panels and raw materials
- The inconsistency, and uncertainty of government incentives
- Lack of training for engineers, construction workers, architects, business people, bankers
- Lack of incentives for new property developers to incorporate into structures.
- Utility opposition in certain regions

Q: What are the main technical and other barriers to greater use of hydrogen?

A: The mounting energy crises and technological advances have industry, academia and government looking to develop hydrogen fuel cells as a viable alternative to fossil fuels. This is a long, but worthwhile journey. Current barriers to the greater use of hydrogen include:

- Lack of education and public awareness about the capabilities, safety and benefits of hydrogen and insufficient research and development funding.
- The need to improve fuel cell, electrolyzer and energy storage technologies by decreasing costs and improving efficiency, integration and lifespan of the equipment. The lack of widespread hydrogen infrastructure must also be addressed.

Q: Do you have any suggestions for what might be done to overcome those barriers?

A: The government is supporting the development of solar and hydrogen technologies to some extent. We would advise increasing this investment and setting out a clear vision – a bold national strategy - with specific milestones that lead towards a clean and

renewable energy economy. Please refer to our written statements for specific recommendations.

Q: How do you see the competition itself as helping to move both solar and efficiency technologies into the mainstream building market?

A: This high-profile competition had a deeply positive impact on helping to move solar and efficiency technologies into the mainstream building market. The core challenge of the Solar Decathlon is to build a beautiful and energy self-sufficient home. At our school, this challenge inspired over 100 students and faculty from the architecture, engineering, interior design, and communications departments to work together to integrate a design vision with engineering and construction realities. The knowledge and experience gained from this project will carry with us as we become the next generation of leaders in our respective fields, and the impact extends from all the decathletes to our families, friends, and colleagues.

Through fundraising and PR efforts, our ideas were shared with many leading figures in the building and energy fields, in addition to countless homeowners. While still at school, people from the community would stop by the site and ask how they too could use solar technologies. While on the National Mall during the event, the flow of people – and the interest they had in solar and efficiency technologies was breathtaking. Everyone wanted "solar" today: *We're still trying to figure out how to install all these PVs in Virginia and Maryland!!!*

2.

Q: What sources of information did you draw on to figure out how to build your house?

A: The team drew upon the vast knowledge and research capabilities of our own students and faculty to build our house. We also collaborated with private businesses and found many willing partners in our community and beyond. People were ready to support the cause. For the solar panels and the hydrogen fuel cell system, we looked to private companies and sought out training courses to assist us with the installation of the systems. The USMMA's Alternative Power program also had great experience with engineering systems.

Q: What problems arose in designing or constructing your house that surprised you?

A: The team encountered a number of challenges throughout this process. One challenge we worked through was how to reconcile competing ideas and visions from the

different disciplines. Another major problem was constant construction delays, and timelines being pushed back. Costs were also constant – constantly rising.

3.

Q: Would your house be commercially viable? If not, what changes would make it more attractive to the mainstream home buyers.

A: With solar power and energy efficient design technologies, it often comes down to a cost/benefit analysis: Is the upfront investment worth the long-term benefits? Is it worth the wait? The NYIT house with the hydrogen fuel cell system is not commercially viable today – though this is what we are working towards. The solar electric, and solar hot water systems *are* because of the incentives that our local utility, the Long Island Power Authority, offer. However, this still requires a large upfront investment.

With regard to the house itself and its design, it is the market that determines whether the product is "commercially viable." Based on interactions with numerous people, we do think that our house is attractive to mainstream home buyers. Importantly, the concept of the modified shipping container with internal mechanics and power systems has many applications – from the military, to disaster relief, to addressing general housing/energy problems across the world. This is certainly essential and viable.